paratus and the very large increase in the amount of literature on the subject within the last twelve years made a second edition of this indispensable book almost imperative. The new edition contains, in addition to a large amount of new matter in the general and special parts, a Newton's scale of prismatic colors (to which reference is made in describing the polarization colors of the different minerals), a practically complete table of petrographical literature and twenty-six photographic plates of mineral and rock sections.——Kalkowsky's "Elemente der Lithologie"[1] is a little treatise of three hundred and sixteen pages, in which the study of rocks is treated as a branch of general geology and not as an appendix to mineralogy. It is intended primarily as an introduction to inorganic geology. In the general part considerable attention is given to the structure, origin and metamorphism of rock masses. In the special part a classification of rocks is attempted, based on the origin of the material of which they are composed. Those whose material was obtained from below are classed as anogenous, those which obtained it from above are called katogenous. Among the latter class belong the sedimentary rocks and the crystalline schists, among which the author places the gabbros and peridotites. Despite the somewhat peculiar views expressed on certain subjects, the book will prove a valuable addition to the library of the lithologist, and a great aid to the student who wishes to study rocks from a geological standpoint.

BOTANY.[2]

THE ADVENTITIOUS INFLORESCENCE OF CUSCUTA GLOMERATA KNOWN TO THE GERMANS.—At the Philadelphia meeting of the American Association for the Advancement of Science, the writer presented a short paper, calling attention to the adventitious inflorescence of *Cuscuta glomerata*. The fact was supposed to be new to science, as it certainly was to the writer, and, moreover, appeared to be to the botanists of the meeting. Additional facts were presented to the Ann Arbor meeting of the Association, and in the discussion the originality of the discovery was not questioned and apparently not doubted by any one.

Imagine my chagrin a few days ago (Dec. 30, 1885), when in running over the text of Dodel-Port's Anatomisch-physiologischen Atlas der Botanik, I found the whole matter fully and accurately described. This atlas was published from 1878 to 1883, in Esslingen. The study of *Cuscuta glomerata* was made in the Botanic Gardens of Zurich, where for ten years or more it has become acclimatized.

On page 4 of part XXX, of the text to the atlas, Dr. Dodel-Port, after describing the normal branching, remarks in substance as

[1] Carl Winter, Heidelberg, 1886.

[2] Edited by Professor CHARLES E. BESSEY, Lincoln, Nebraska.

follows, viz: "Besides this normal branching there is a copious formation of adventitious shoots. These are formed endogenously upon the best nourished parts of the Cuscuta stem, and also upon the parts which bear the haustoria, where the host-plant and parasite are in immediate contact. The rudimentary shoot-buds are formed beneath the cortex of the Cuscuta stem, and break through in a manner similar to the lateral roots of vascular plants. They develop either into inflorescences, or upon injury to the rest of the plant, into vegetation shoots."

These adventitious branches were also noticed, very briefly and somewhat vaguely, by Solms-Laubach in a paper on Parasitic Phanerogams in Pringsheim's Jahrbuch für wissenchaftliche Botanik, vol. VI, 1868.—*Charles E. Bessey.*

SYMBIOSIS BETWEEN A FUNGUS AND THE ROOTS OF FLOWERING PLANTS.—In investigating the structure of the vegetative organs of *Monotropa hypopitys*, M. F. Kamienski (Mem. de la Soc. Nationale des Sciences Naturelles de Cherbourg) came to the conclusion that it is not a parasite, the most careful observation failing to detect any haustoria or other parasitic union with the root of any host. On the other hand he found the root of the Monotropa to be completely covered by the mycelium of fungus which branches abundantly and forms a pseudo-parenchymatous envelope, often two or three times the thickness of the epidermis, and especially well-developed at the apex of the root. This fungus, the species of which M. Kamienski was unable to determine, is entirely superficial, not penetrating into the living cells, though occasionally forcing its way between those of the epidermis. He contends that the Monotropa derives its nutriment from the soil entirely through the medium of this fungus-mycelium. The only parts of the root which are in actual contact with the soil are composed of lifeless cells with no power of deriving nutriment from it. The connection of the fungus with the roots of the Monotropa is not one of parasitism, but of true symbiosis, each of the two organisms deriving support and nutriment from the other.

More recently Dr. B. Frank and M. Woronin (Bericht Deutsch. Bot. Gesellschaft) have made similar observations of the mode of nutrition of Cupuliferæ and Coniferæ. Dr. Frank finds the roots of our native oaks, beeches, hornbeams, chestnuts and hazels to be covered by a dense cortex, to which he gives the name Mycorhiza, organically associated with them in growth, and composed entirely of fungus-hyphæ, completely enveloping the whole of the root, even the growing point. The structure of this cortex is that of a sclerotium; it is composed of a dense mass of hyphæ, varying in diameter from 2 to 10^{mm}, usually in several layers, from which other endophytic hyphæ penetrate into the root between the epidermal cells, which are still slenderer than those of the envelope.

By this structure the formation of root-hairs by the tree is entirely prevented, and it is through it alone that it is able to absorb nutriment out of the soil. It makes its appearance first on the lateral roots of the young seedling, and is constantly being replaced by fresh formations on older roots. Dr. Frank found this structure invariably on every root examined of trees belonging to the Cupuliferæ, also occasionally on Salicaceæ and Coniferæ, but never on woody plants belonging to other natural orders, nor on any herbaceous plant. It is quite independent of the nature of the soil. He also regards the phenomenon as an example of symbiosis, comparable in all essential points to that of lichens, the Mycorhiza corresponding to the fungal element in the lichen, the tree itself to the algal gonidia.

Dr. Woronin confirms these statements in relation to Coniferæ, Salicaceæ, and some other trees, and thinks it probable that the fungus, which he regards rather as truly parasitic, is a Boletus.—*A. W. Bennett.*

Internal Spore-Formation in Diatoms.—Count Abbé F. Castracane describes (Accad. Pontif. de' Nuovi Lincei) a remarkable appearance in a deposit of marine diatoms of Pliocene date from the Apennines. In a specimen of *Coscinodiscus punctulatus* he observed that the lower part of the valve, minutely punctuated in radial disposition, showed small uniform round stalked bodies; drawings under the camera lucida showed clearly their circular figure. No other interpretation of these minute round bodies, always found in the interior of the frustule, seems possible, except that they constitute a nest of embryonal diatoms on the point of escaping from the mother-cell. This is in accord with previous observations of the author on similar round bodies seen on the point of escaping from a Podosphenia, and with observations of Rabenhorst and O'Meara. The fact that the diatoms in which these bodies were observed had previously been treated with boiling sulphuric acid with addition of potassium chloride, shows conclusively that the round bodies seen to escape from living diatoms are not Infusoria or other organisms fortuitously collected round them, and demonstrates at the same time that, from the first moment of their existence, diatoms must be provided with a siliceous coating, though it may be of extreme tenuity. It would seem from these observations that diatom may assume the function of a sporangium, producing in its interior embryonal forms by which the species is reproduced, and which ultimately acquire the form and approximately the size of the mother-frustule.

In connection with this subject, Mr. F. Kitton states (Jour. Quekett Micros. Club) that he found on carafes of water a film composed entirely of frustules of *Achnanthes linearis;* but on filtering the water, these were never found on the filter-paper, and when the filter-paper was boiled in decarbonized sulphuric acid,

the residue showed no indication of carbonaceous remains. In the course of a few days a film again began to appear on the filtered water, which was found to consist entirely of the same diatoms. A control experiment showed that none of these diatoms, though exceedingly minute, would pass through the filter-paper employed, and the conclusion seems inevitable that the diatoms must have passed through in the form of microspores.—*A. W Bennett.*

BOTANICAL LABORATORIES IN THE UNITED STATES.—In a most instructive paper in the December number of the *Botanical Gazette*, Mr. Arthur gives descriptions of some of the more important botanical laboratories in this country. Those noticed are the following:

1. *Harvard University.* (*a*) The laboratory in connection with the Botanic Gardens. (*b*) The laboratory of Cryptogamic Botany in the Agassiz museum. (*c*) The laboratory of phanerogamic botany in Harvard Hall. Twenty-one compound microscopes are supplied to these.
2. *Cornell University.* (*a*) The laboratory for analytical and general phanerogamic work with eleven dissecting microscopes. (*b*) The microscopical laboratory and conservatory, supplied with twelve compound microscopes.
3. *University of Pennsylvania.* (*a*) Laboratory for junior work, containing an outfit of dissecting microscopes. (*b*) Laboratory for senior work. These contain twenty-four compound microscopes.
4. *Illinois University.* Laboratory and green-houses, supplied with twenty-one compound microscopes.
5. *Michigan Agricultural College.* Laboratory and conservatory, supplied with twenty-seven compound microscopes.
6. *University of Michigan.* (*a*) Microscopical laboratory, with forty-three microscopes. (*b*) The botanical laboratory proper, with six microscopes.
7. *Iowa Agricultural College.* Laboratory supplied with twenty-one compound microscopes.
8. *Wabash College.* (*a*) Laboratory for elementary botany, with an outfit of dissecting microscopes. (*b*) Laboratory for advanced botany, supplied with twenty compound microscopes.
9. *Perdue University.* Laboratory supplied with twenty-five compound microscopes and an equal number of dissecting microscopes.
10. *University of Wisconsin.* (*a*) Laboratory for elementary work, supplied with eleven dissecting microscopes. (*b*) Laboratory for advanced work, supplied with twenty-five compound microscopes.
11. *University of Nebraska.* Laboratory supplied with twenty-five dissecting microscopes, and thirty-six Coddington hand-lenses, for elementary work; and twenty-two compound microscopes for advanced work.
12. *The Shaw School of Botany.* Laboratory supplied with sixteen dissecting microscopes for elementary work, and four compound microscopes for advanced work.

LINHART'S UNGARNS PILZE, CENTURY IV.—This important distribution of Fungi deserves mention again, both on account of the beauty of the specimens and the low price at which they are furnished. The century before us contains thirty-six species of Uredineæ, three of the Ustilagineæ, six of Peronosporeæ, three of Erysipheæ, etc., etc. Good plates are given of fifteen species, and in these the microscopical details of structure are quite satisfactorily worked out. When these plates are mounted upon the same herbarium sheets as the specimens which they illustrate, they will prove very useful and instructive, especially to the beginner in Fungology.

BOTANICAL NEWS.—The "Laboratory number" (Dec.) of the *Botanical Gazette* is one of the most valuable issued during the past year. The special laboratory topics are, Some botanical laboratories of the United States; Laboratory appliances; The laboratory at Strasburg; Laboratory courses of instruction; Section cutting, besides a dozen or so general notes devoted to some phase of the subject.——A late number of *Flora* contains a paper on the infloresence of Typha, by Celakoosky.——No. 141 of the Journal of the Linnean Society contains: (1) Contributions to the Flora of the Peruvian Andes, with remarks on the history and origin of the Andean Flora, by John Ball; (2) Contributions to South-African botany, by H. Bolus and N. E. Brown; (3) A contribution to the study of the relative effects of different parts of the solar spectrum on the transpiration of plants, by George Henslow.——The December *Torrey Bulletin* contains the summary of another year's work upon the fresh-water Algæ of the United States, by Francis Wolle. Several new species are described, viz: *Ectocarpus rivularis* (Florida), *Œdogonium cataractum* (Florida), *Dictyosphærium hitchcockii* (N. J.), *Zygnema purpurea* (N. J. and Fla.), *Mesocarpus crassus* (Fla.), *Staurastrum tokopekaligense* (Fla.), besides a number of varieties. A plate of Desmids accompanies the paper. ——The *Gardeners' Monthly*, while not professing to be a botanical journal, contains much of value and interest to the botanist. Thus in the January number we find papers on the following subjects, viz: A new pitcher-plant (*Sarracenia courtii*), The so-called hardy Catalpa, Large sassafras trees, *Amaryllis treatæ*, The mistletoe in different localities, besides many notes and notelets.—— Gerald McCarthy, of Kendall Green, Washington, D.C., announces a distribution of plants of Eastern North Carolina, including 340 species at $21.——For those intending to buy botanical works we are doing a good service when we call attention to John Wheldon's botanical catalogues (58 Great Queen street, London, W. C., Eng.).——The Index to the twenty-third volume of the *Journal of Botany*, just closed, enumerates an unusually great amount of valuable matter. Among the contributors are the well known names of J. G. Baker, A. W. Bennett, M. C. Cooke, J. M. Crombie, W. B. and H. Groves, W. B. Hensley, M. T. Masters, F. von Mueller, Henry Trimen, etc.——One of the pleasant features of the past few months has been the attention given in so many journals to notices of Dr. Gray. The latest of these which we have is a neat paper reprinted from the *Sun* newspaper of Jan. 3, and entitled "Asa Gray." It is from the hand of Professor C. S. Sargent, and gives a summary of the life and labors of the eminent botanist. Very like the foregoing is the paper in the January *Botanical Gazette*, by Professor C. R. Barnes. In this paper, however, we have more of the personal history. It is accompanied by a fine heliotype.